National Grid SA Protection Data Management System
Power System Protection Intelligent and Sustainable Work flow

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Outline

• Problem definition.
• Solution Implementation
• Achievements (what we gain)
• Conclusion
Data Quality is Essential for Operation & Maintenance Efficiency

- This is a worldwide problem in most utilities.
- Data are not existing in required quality.
- Difficult to have the data on the right time.
- Discrepancies between field and office data;
- Historically information is not available.
- With digital relays: Managing relay files is as well very problematic.
OVERVIEW ABOUT NATIONAL GRID NETWORK IN SAUDI ARABIA

- 50 years old transmission network.
- Load reaches more than 62 Giga watts in summer 2015.
- More than 1,000 number of locations (380KV to 110KV).
- Huge number of relays (more than 120,000 relays).
- Huge & variance number of relay setting parameters:
  - Electromechanical: up to 20 parameters;
  - Static - Electronic: up to 50 parameters;
  - Microprocessor Digital: up to 20,000 parameters. (70%)
- More than 50 new substations added per year.
NOT HAVING PROTECTION DATA MANAGEMENTS

• Will not Capable to Implement comprehensive studies.

• You will have huge impact in Maintenance Efficiency.

• Cannot be fast in Fault analysis.

• Will not have historical & recorded data.

• Will not Improve settings implementation quality.

• Will not Take the write dissections regarding protection system replacements & Setting validation.

• Will not establish protection setting work flow cycle
Protection Data Management System (PDMS) Target

Establish

Comprehensive Enterprise Sustainable Protection Data System

Capable to:

- Manage, control and deliver data to all involved applications;
- Insure optimal protection relays behavior.
- Accurate data Managements.
- Establish protection settings work flow cycle

Increase network reliability & Maintenance Efficiency.
National Grid SA - Sustainable Protection Data Management Projects

- Wide Area Protection Coordination Study Review, Controlling, Improvement
  - On going
- Network Modeling Simulation Tool
- Protection Data Management System
  - Done
- Comprehensive Field Data Collection
TOWARDS SUSTAINABLE DATA MANAGEMENTS

PROTECTION DATA MANAGEMENT SYSTEM & COMPREHENSIVE FIELD DATA COLLECTION
COMPREHENSIVE FIELD DATA COLLECTION

• Pilate Project in beginning on 2015.
• Real Project Started on November 2015.
• More than 920 locations have been visited & protection data have been collected within 6 months.
• 7 Teams distributed between the regions.
• Protection Data for 120,000 Relays have been collected and Verified.
• About 150,000,000 Setting parameters have been converted and Migrated.
COMPREHENSIVE FIELD DATA COLLECTION - CHALLENGES

• Organize field work for 7 teams and 28 people.

• Organize work to track activities of all field Teams.

• Many network changes during the executing of the projects.

• Estimating the project flow & plan for visiting substations:
  • Logistic issues
  • Restricted areas Permission
  • Accommodations
  • Long distance.
  • Remote Substations.
DATA VERIFICATION CHALLENGES

• Processing, relay data model checking, verification and import of more then ~1000 relay settings per day.

• Number of different protection types: Expected 230 / Actual 1000 relay type.

• Development and implementation of new relay setting models.
FDC STEP 0 – CREATION OF LOCATION HIERARCHY

- information about physical location for each protection relay;
- minimum following levels:
  - Substation
    - Voltage Level
    - Feeder
- implemented based on Substation Single Line Diagrams (SLD)
FDC STEP 0 – CREATION OF LOCATION HIERARCHY
FDC STEP 1 - VERIFICATION OF LOCATION INFORMATION
FDC STEP 2 - COLLECTION OF GENERAL PROTECTION ASSET INFORMATION
**FDC STEP 3 (FINAL) - COLLECTION OF RELAY SETTING INFORMATION**

### Downloadable Relay Data

- **Location Path:** IPS/Test Substation/330 kV/Feeder 01/
- **Asset Name:** SEL-311C
- **Asset Type Name:** SEL-311C
- **Software Type:** SEL-5010
- **Software Version:**
- **Native file:**
  - Upload Native File
  - Save File
- **Help:** How to generate an export file
- **Relay converted file:**
  - Upload Converted File
  - Save File
- **Native file name:** T161_32_SPAR64_SEL311-7_RSR_A4962.MDB
- **Native file size:** 233472
- **Converted file name:** SEL311C_ENG_01.xml
- **Converted file size:** 742106
- **Expected file manufacturer:** SEL
- **Expected native file extension:** .MDB
- **Expected converted file extension:** .TXT, .XML
- **RELEX logical model:** N/A

### Nondownloadable Relay Data

- **Location Path:** IPS/Test Substation/330 kV/Feeder 01/
- **Asset Name:** CAG19
- **Asset Type Name:** CAG19
- **Assigned RELEX Logical Models**
  - ![Highlighted Model](image)
  - ![Highlighted Model](image)
- **Relay Parameters**
  - ![Highlighted Parameters](image)
  - ![Highlighted Parameters](image)
# FDC Error Tracking & Statistics

## Reports

- FDC Error Tracking - Not Finally Verified Relays
- FDC Error Tracking - Digital Relays Without Settings
- FDC Error Tracking - Digital Relays Without Settings By Error

<table>
<thead>
<tr>
<th>Location Path</th>
<th>Substation</th>
<th>Manufacturer</th>
<th>Asset Type</th>
<th>Asset Name</th>
<th>Model</th>
<th>Serial</th>
<th>Status</th>
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<td>NGR/CENTRAL/1</td>
<td>S3005</td>
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<td>S40</td>
<td>S40</td>
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<td>TSC MAIN...</td>
<td>CPR04...</td>
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<td>ABB</td>
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<td>ABB</td>
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</tr>
</tbody>
</table>
PROGRESS TRACKING

Grey: data collection did not start.
Yellow: data collection in progress;
Green: data collection, data verification, data correction and data converted into production EPIS database;
Red flashing: problem with substation data collection

<table>
<thead>
<tr>
<th>LOCATIONS</th>
<th>Completion IN %</th>
</tr>
</thead>
<tbody>
<tr>
<td>East (SS+NG Room)</td>
<td>99.5%</td>
</tr>
<tr>
<td>West (SS+NG Room)</td>
<td>100%</td>
</tr>
<tr>
<td>South (SS+NG Room)</td>
<td>100%</td>
</tr>
<tr>
<td>Central (SS+NG Room)</td>
<td>100%</td>
</tr>
<tr>
<td>Isolated Areas</td>
<td>100%</td>
</tr>
<tr>
<td>380kV (SS+NG Room)</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>No. of Surveyed Locations</th>
<th>Total Data Collection Completion IN %</th>
<th>No. of Surveyed Relays</th>
<th>Training Completion IN %</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>925</td>
<td>99.9%</td>
<td>119,741</td>
</tr>
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</table>

The map shows the locations with different colors indicating the status of data collection.
NATIONAL GRID-SA NOW HAVE Protection Data Management System
One Automated platform
NOW IN NATIONAL GRID

- Accurate data about protective relays;
- Accurate data about power system network;
- Accurate knowledge about existing settings;
- Integrated solution to allow data exchange between all involved systems.
- Asset management tool with historical & recorded data.
- Clear Protection setting work flow cycle policy.
- Capability to Implement comprehensive studies.
- Capability to do Faster Fault analysis.
NOW IN NATIONAL GRID

• Can take the right dissection regarding the protection assets on the right time.

• Can issue setting from one platform & easily verify setting implementation.

• Can improve settings implementation quality (comparison tools).

• Can track & report protection data (Relay models, versions, locations, disturbance, ....)

We can say:

We are among the first class utilities in this subject
THANK YOU